Kaolin, lime and rock dusts to control *Drosophila suzukii*

Strack T[1,2], Cahenzli F[1] & Daniel C[1]

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Abstract

North America, infesting various soft-skinned fruits. Because D. suzukii attacks ripening fruits shortly before harvest, only insecticides with short pre-harvest intervals can be applied. Alternatively, kaolin, lime and rock dusts are non-toxic to non-target organisms, but the whitish coating on fruits potentially deters oviposition of D. suzukii. Therefore, we tested oviposition deterrence and insecticidal effects of such substances. Female D. suzukii flies were exposed to treated blueberries under laboratory conditions for 24 hours. Kaolin, clinoptilolite, clinoptilolite + Heliosol (pine-oil based wetting agent) and calcium carbonate significantly reduced oviposition, whereas calcium hydroxide only had a marginal effect and diatomaceous earth had no significant effect. None of the tested products had an insecticidal effect. Kaolin, lime and rock dusts are therefore a promising tool to reduce damage of D. suzukii in soft-skinned fruits.

Introduction

The spotted wing drosophila *Drosophila suzukii* Matsumura (Diptera: Drosophilidae), a devastating pest of soft-skinned fruit crops, is originally native to Southeast Asia, but has been introduced into Europe (Calabria et al. 2012). In contrast to native Drosophilidae, *D. suzukii* females possess a serrated ovipositor to cut through the epicarp of their host fruit. Thus, they can feed and oviposit on previously undamaged fruits. Since *D. suzukii* prefers ripe fruits shortly before harvest, only insecticides with short pre-harvest intervals can be applied. Alternatively, kaolin, lime and rock dusts are non-toxic to non-target organisms (EPA 1999), but the whitish coating on fruits potentially deters oviposition due to particle inherence on insect bodies and/or (in case of lime products) due to altered pH level and microorganism flora (Ebeling 1971, Daniel 2014). In a laboratory experiment, we tested oviposition deterrence and insecticidal effects of different dusts products (kaolin, clinoptilolite, clinoptilolite + Heliosol, calcium carbonate, calcium hydroxide and diatomaceous earth) by exposing treated blueberries to *D. suzukii* females.

Methods

Cleaned organic blueberries (Snowchase, Spain) were treated to run-off in a spinning table spray booth with the following substances dissolved in deionized water: Spinosad (0.025 % Audienz, Omya AG), kaolin (2 % Surround, Stähler Suisse SA), clinoptilolite (2 % Klinospray, Unipoint AG), clinoptilolite (2 %) + 0.5 % Heliosol

[1] Forschungsinstitut für biologischen Landbau (FiBL), Ackerstrasse 113, 5070 Frick, Schweiz, claudia.daniel@fibl.org, fabian.cahenzli@fibl.org

[2] Hochschule Geisenheim, Von-Lade-Strasse 1, 65366 Geisenheim, Deutschland, timo.strack@gmx.de

(Omya), calcium carbonate (1.7 g/l, 95% pure), calcium hydroxide (1.7 g/l Nekapur, Kalkfabrik Netstal AG) and diatomaceous earth (0.34 g/l Pflanzen-Aktivator P2032, AMU-Systeme). Deionized water was applied to the control berries. Three berries were provided in cardboard cups to six *D. suzukii* females for oviposition. After 24 hours, mortality of adult flies and the number of eggs were counted under a binocular. A generalized linear model with Poisson errors was fitted to the number of eggs laid and analyzed with a Tukey post-hoc test. Efficiency of the substances was calculated according to Abbott: 100 * (1- [number of eggs laid in treated berries] / [number of eggs laid in untreated berries]).

Results and discussion

Kaolin, clinoptilolith, clinoptilolith + Heliosol and calcium carbonate significantly reduced oviposition, whereas diatomaceous earth had no significant effect (Fig. 1). Calcium hydroxide had a marginal effect on oviposition (P = 0.07). In contrast to Spinosad, where almost all flies already died after 12 hours, the tested substances showed no insecticidal effects (only one single fly died in the Kaolin treatment). By physical deterrence, kaolin reduced oviposition as effectively as Spinosad, which prevented oviposition by killing the flies. However, visible residues make the use of kaolin unsuitable in table fruits. Calcium carbonate caused less visible residues and reduced oviposition also significantly, but could affect vinification of grapes by altering the pH level (Daniel et al. 2015). In accordance to the crop and its processing, kaolin, lime and rock dusts offer an interesting opportunity to reduce fruit damage by *D. suzukii.*

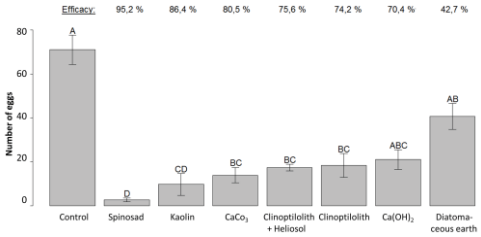

Figure 1: Number of eggs laid on blueberries treated with different dust products 24 hours after exposition. (Mean values ± standard errors, *P* < 0.05). Different letters indicate significant differences between treatments.

Literatur

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